

# WIND BRACING



**Fairfax County**  
**VIRGINIA**

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Department of Public Works and Environmental Services

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This publication provides guidelines for complying with the wall bracing provisions of the 2003 *International Residential Code* (IRC) so that your new house or addition can adequately resist horizontal load imposed by wind.

### *in this publication:*

<b>WIND LOAD BASICS .....</b>	<b>1</b>
<b>INTERMITTENT BRACING.....</b>	<b>4</b>
<b>NARROW PANELS FOR INTERMITTENT BRACING .....</b>	<b>7</b>
<b>CONTINUOUS SHEATHING .....</b>	<b>9</b>
<b>NARROW PANELS FOR CONTINUOUS SHEATHING – PORTAL FRAMES.....</b>	<b>14</b>
<b>HORIZONTAL BLOCKING.....</b>	<b>15</b>
<b>INTERIOR BRACED WALL LINES .....</b>	<b>16</b>
<b>PROPRIETARY SYSTEMS .....</b>	<b>17</b>
<b>ENGINEERED DESIGN .....</b>	<b>17</b>
<b>FREQUENTLY ASKED QUESTIONS.....</b>	<b>18</b>

## WIND LOAD BASICS

### LATERAL LOAD

All buildings are subject to vertical and lateral loads. Vertical loads consist of people, furniture, snow and the weight of the building itself. **Lateral load** is primarily wind and seismic forces. In Fairfax County, wind load governs lateral design for residential construction. Wind load is unique in that it can act in any direction; therefore a building must be able to resist loads acting parallel and perpendicular to any wall of a building.

The design wind load on a structure is based on the local wind speed. For Fairfax County, the wind speed is **90 mph** based on a 50-year recurrence interval measured in 3-second gusts at 33 feet above the ground. While this wind speed might seem extreme, the methods and formulas built into the code, which take a building's use, height, shape and location into affect, translate the wind speed to realistic bracing requirements.

### LOAD PATH

All structures must be designed to transfer vertical and horizontal loads from the areas in which the load is applied all the way to the foundation. This is called **load path**.

For example, in a simple one-story house, as shown in FIGURE 1, wind that blows against the end wall causes a pushing force on the wall and a pulling force on the opposite end wall. The combined load causes the roof to want to move in the direction of the wind.

The movement of the roof is resisted by the side walls which will hold back the wind forces. The walls ability to resist this forward motion is dependent on its stiffness and the attachment of the wall to the foundation below.

The load path process would be similar if the house had multiple floors. In these cases, the side walls of the first floor have the added responsibility to resist the forward movement of all the floors and the roof above. Since the walls of the first floor resist more load, they have stricter requirements for their design.

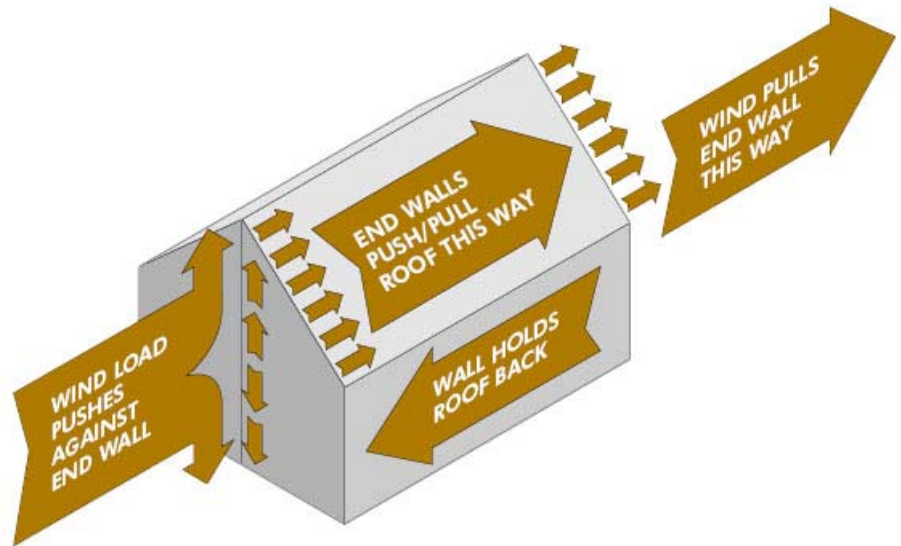


FIGURE 1: WIND LOAD APPLIED TO A HOUSE

### BRACED WALL PANELS

The stiffness of an exterior wall is dependent upon the amount of bracing or sheathing on the wall. When wall bracing is installed along a specified length of a wall, it prevents lateral displacement caused by wind load. As shown in FIGURE 2, a typical wall of a house will rack due to wind load if no bracing is provided.

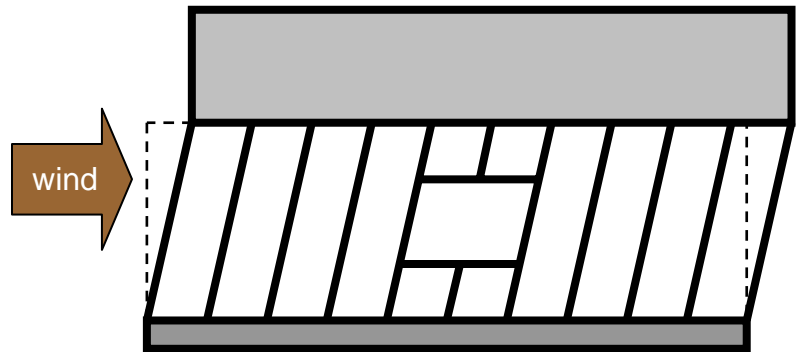


FIGURE 2: RACKING DUE TO WIND LOAD

A **braced wall panel** is a unit of bracing that is placed along an exterior wall from the bottom plate to the top plate at specified locations. All exterior walls require a certain amount of *braced wall panels*. As shown in FIGURE 3, a *braced wall panel* is placed at each end of the wall providing the stiffness required to resist the imposed wind load. Each *braced wall panel* is measured by its length and height; see FIGURE 4.

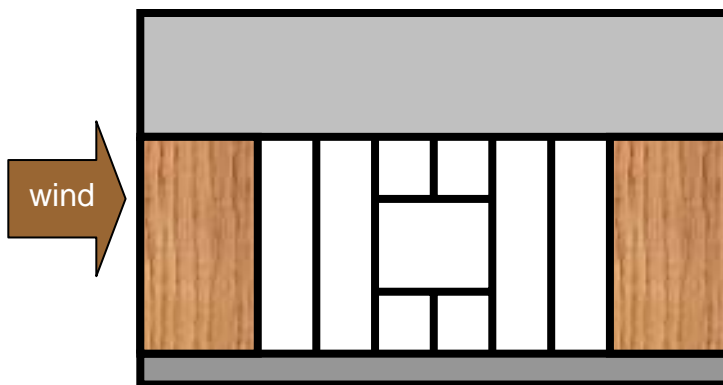


FIGURE 3: TYPICAL WALL WITH BRACING

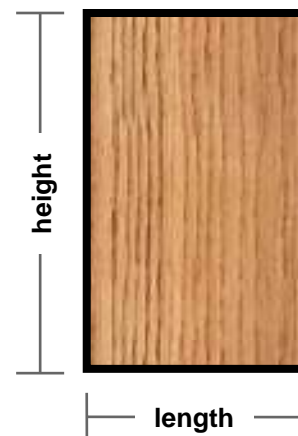
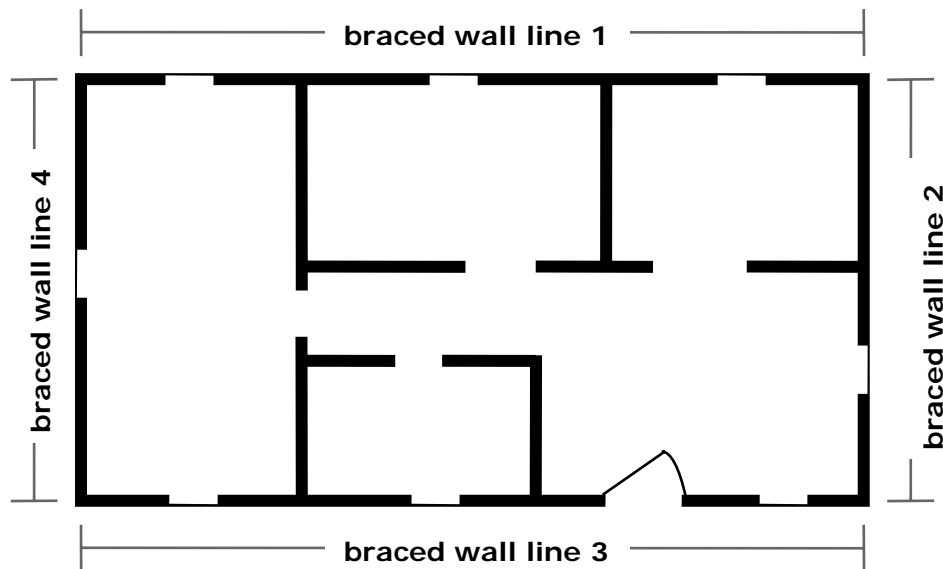


FIGURE 4: BRACED WALL PANEL

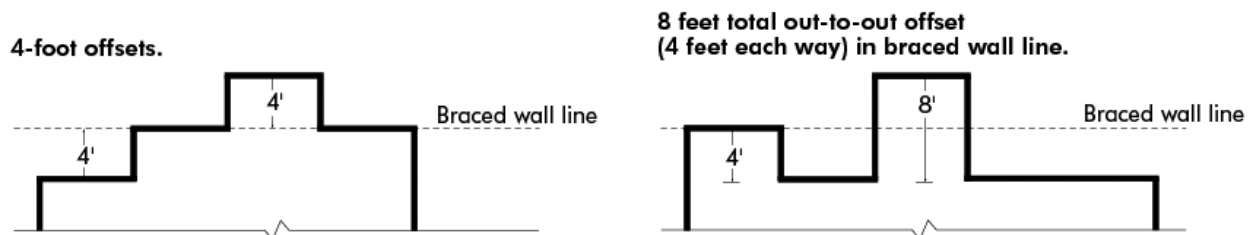
### BRACED WALL LINES

*Braced wall lines* are the exterior walls of a house that contain a series of *braced wall panels*. For instance, in a simple rectangular house, as shown in FIGURE 5, there are four *braced wall lines*. For interior *braced wall lines* and *braced wall line* spacing, see page 16.



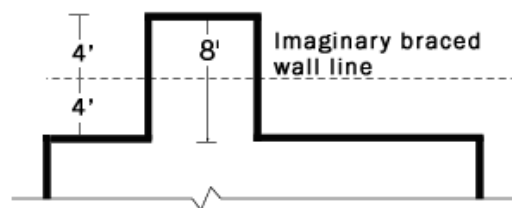
**FIGURE 5: BRACED WALL LINES OF A SIMPLE HOUSE**

However, there aren't too many simple rectangular houses in Fairfax County. Therefore, the IRC allows jogs in the entire side of a house and continue to be considered the same *braced wall line*. No single offset can be more than 4' and the total out-to-out dimension of all offsets can be no more than 8'. In FIGURE 6, the braced wall lines are identified with the dashed lines. All of the walls on the side of the house which are parallel with the dashed lines are considered part of the same *braced wall line* since they are 4' or less from the dashed line. This distinction becomes important when determining the amount and location of *braced wall panels*, see page 4.

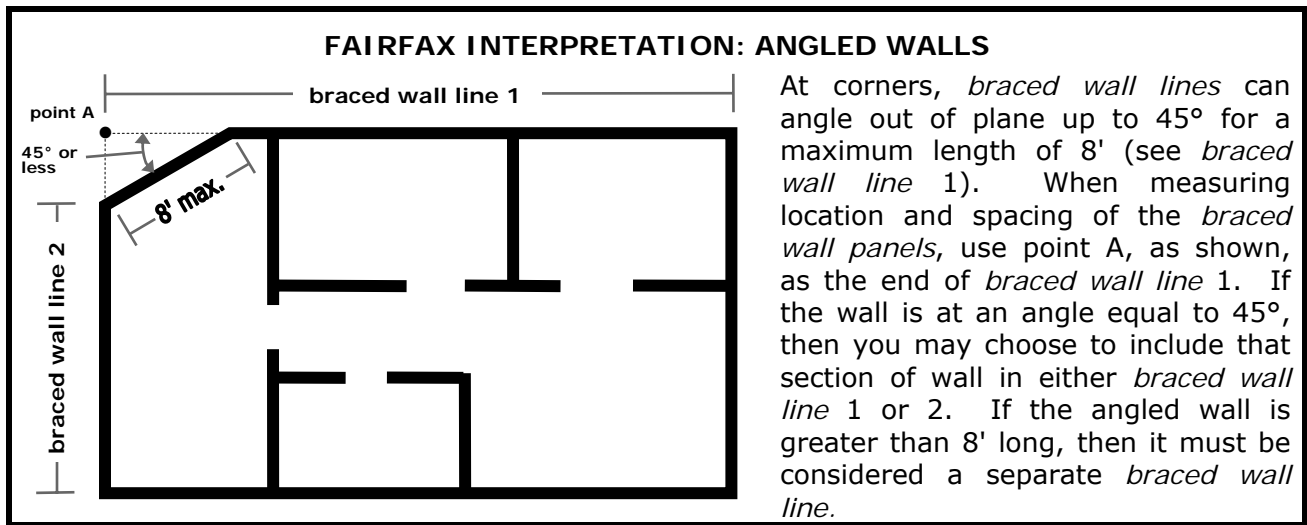


**FIGURE 6: ALLOWABLE OFFSETS OF A BRACED WALL LINE**

### **FAIRFAX INTERPRETATION: IMAGINARY BRACED WALL LINE**



A *braced wall line* can be strategically placed to maximize the number of wall sections in a *braced wall line* even if it doesn't align with a section of wall. As shown in the figure to the left, the dashed line does not line up with an actual wall, but the walls above and below the "imaginary" *braced wall line* are within 4'. Therefore all the parallel walls on the side of the house are considered the same *braced wall line*.



## INTERMITTENT BRACING

When using the IRC to determine bracing requirements, there are two approaches to use: **intermittent bracing** and **continuous sheathing**. Each has its benefits and gives designers the flexibility to optimize window or door openings while still providing the minimum amount of bracing. You can even mix the two approached from floor to floor and from *braced wall line* to *braced wall line*.

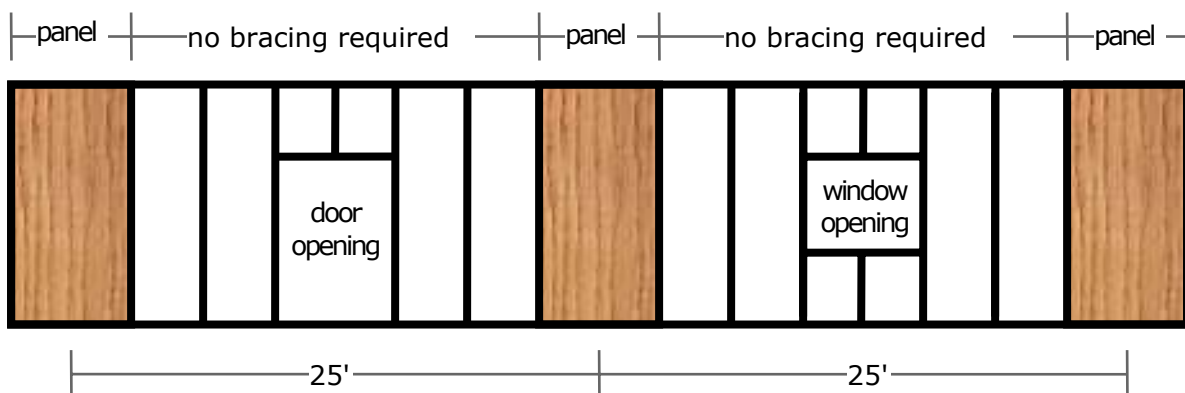
This section explains intermittent bracing; for continuous sheathing, see page 9.

### MINIMUM LOCATION OF INTERMITTENT BRACING

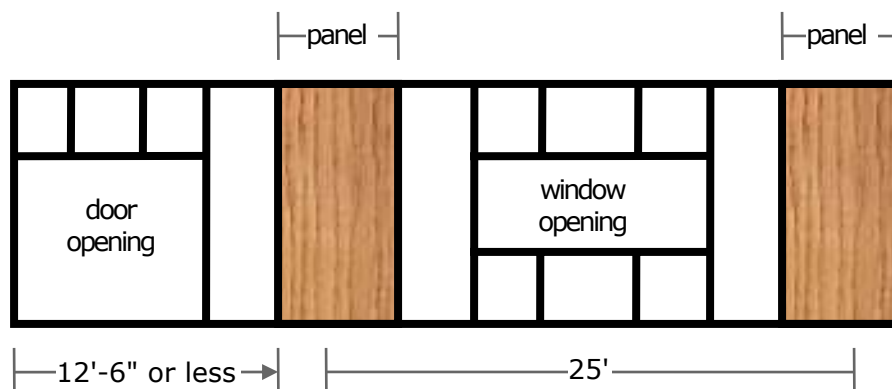
Each *braced wall line* must have a *braced wall panel* at each end and at a spacing no greater than 25' on center; see FIGURE 7.

To allow greater design flexibility, the IRC allows the panels at the end of a *braced wall line* to begin within 12'-6" of the end; see FIGURE 8. *Braced wall panels* can be offset at each end of the *braced wall line* only if the spacing of the panels is 25' or less and the minimum amount of bracing is provided. To determine the minimum amount of intermittent bracing, see page 6.

The areas between the *braced wall panels* and the areas above and below the window or door openings require no bracing and can be faced in an alternate material such as insulated foam.



**FIGURE 7: SPACING OF INTERMITTENT BRACED WALL PANELS**



**FIGURE 8: OFFSET OF INTERMITTENT BRACED WALL PANELS**

### INTERMITTENT BRACING METHODS

The IRC identifies eight unique bracing methods to construct a *braced wall panel* for intermittent bracing. Each method has a specified material type, minimum material thickness and attachment criteria; see TABLE 1 and FIGURE 9. Panel lengths and heights are shown in TABLE 2. Panel methods may not vary within the same *braced wall line*.

**TABLE 1: INTERMITTENT BRACING METHODS**

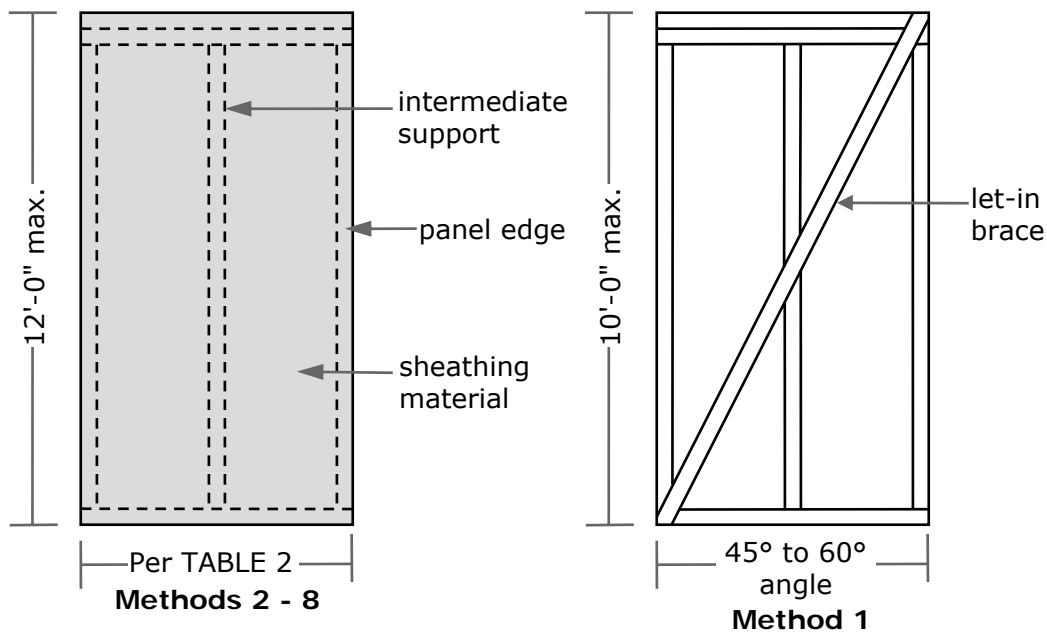
Method	Material	Minimum Thickness	Connection Criteria
1	let-in bracing	1x4 wood or approved metal bracing @ 45° to 60° angle	wood: 2-8d nails per stud metal: per manufacturer
2	diagonal wood boards @ 24" o.c.	$\frac{5}{8}$ "	2-8d nails per stud
3	OSB or plywood sheathing	$\frac{5}{16}$ " for studs @ 16" o.c. $\frac{3}{8}$ " for studs @ 24" o.c.	6d nails @ 6" o.c. (panel edges) and @ 12" o.c. (interior supports)
4	fiberboard	$\frac{1}{2}$ " or $\frac{25}{32}$ " for studs @ 16" o.c. only	$1\frac{1}{2}$ " galvanized roofing nails @ 3" o.c. (panel edges) @ 6" o.c. (interior supports)
5	gypsum board (drywall)	$\frac{1}{2}$ "	exterior: $1\frac{1}{2}$ " galvanized roofing nails or 8d nails @ 4" o.c. (panel edges) @ 8" o.c. (interior supports) interior: type S or W "drywall" screw @ 12" o.c. (24" spaced studs) @ 24" o.c. (16" spaced studs) (spacing at panel edges and interior supports are equal)
6	particle board	$\frac{3}{8}$ " or $\frac{1}{2}$ " for studs @ 16" o.c. only	$1\frac{1}{2}$ " galvanized roofing nails @ 3" o.c. (panel edges) @ 6" o.c. (interior supports)
7	Portland cement plaster	3 coats with corrosion resistant lath	Attach lath with $1\frac{1}{2}$ ", 11 gage nails @ 16" o.c. or 16 gage staples @ 6" o.c.
8	hardboard	$\frac{7}{16}$ "	0.099" min. nail diameter to perforate framing $1\frac{1}{2}$ " min. @ 4" o.c. (panel edges) @ 8" o.c. (interior supports)

**TABLE 2: LENGTH OF BRACED WALL PANEL**

Method	Wall Height				
	8'	9'	10'	11'	12'
2, 3, 4, 5*, 6, 7, 8	48"	48"	48"	53"	58"
5**	96"	96"	96"	106"	116"

\* applied to both sides

\*\* applied to one side

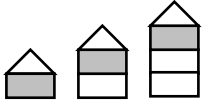
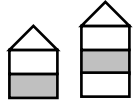



**FIGURE 9: INTERMITTENT BRACED WALL METHODS**

**MINIMUM AMOUNT OF INTERMITTENT BRACING**

Each *braced wall line* must also have a specified percentage of its length contain bracing based on which bracing method you have chosen and the number of floors above the *braced wall line*. See TABLE 3 and EXAMPLE 1 below to determine percent bracing required.

**TABLE 3: PERCENT BRACING REQUIRED\***

Floor		Method-3 only	Methods 2, 4, 5, 6, 7, 8
	One story house or top floor of a two or three story house.	16%	16%
	First floor of a two-story or second floor of a three-story house.	16%	25%
	First floor of a three-story house.	25%	35%

\* Method-1 need only comply with the location and spacing requirements noted on page 4; however, Method-1 is prohibited from the first floor of a three-story house.

**EXAMPLE 1: How to evaluate compliance of a *braced wall line* with intermittent bracing.**

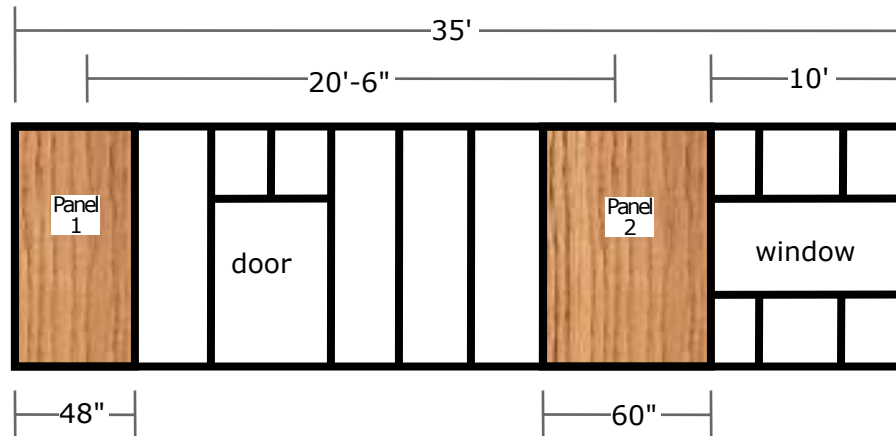
1. Determine *braced wall panel* method.
2. Determine length of *braced wall line*.
3. Determine which floor the *braced wall line* is located.
4. Based on above, choose the minimum percentage of bracing required from TABLE 3.
5. Compute the actual percent bracing. Only panels greater than or equal to 48" can contribute.

$$\text{Actual percent of bracing} = \frac{\text{sum of all panel lengths (in inches)}}{\text{length of braced wall line (in feet)} \times 12} \times 100$$

6. Compare percentages; ensure the actual percentage is greater than the minimum percentage required from Step 4.

7. Ensure panels are spaced no more than 25' on center and are located at each end of the *braced wall line* or within 12'-6" of the end.

**For example:** Using the 35' long *braced wall line* below, and OSB sheathing for the first floor of a three-story house, determine if the *braced wall line* is in compliance.



1. Determine method: for OSB, this is Method-3.
2. Length of *braced wall line* is 35'.
3. This is the first floor of a three-story house.
4. Using TABLE 3, the minimum percent bracing required is 25%.
5. & 6. Panels 1 and 2 are greater than or equal to 48", therefore both can contribute. Compute actual percent bracing:
 
$$\% \text{ bracing} = \frac{48 + 60}{35 \times 12} \times 100 = 25.7\% > 25\% \text{ (required \%)}$$
6. Actual % > Required %, *braced wall line* PASSES!
7. For this 35' wall, the 48" panel is located at one end of the *braced wall line* and the 60" panel begins within 12'-6" from the other end. The spacing between the centerlines of each panel is less than 25'.  
***Braced wall line complies.***

## NARROW PANELS FOR INTERMITTENT BRACING

If you require more windows and openings in your walls such that a 48" *braced wall panel* is too long, you have two options that allow you to reduce the panel length, the ***alternate braced wall panel*** and the ***intermittent portal frame***.

### ALTERNATE BRACED WALL PANEL

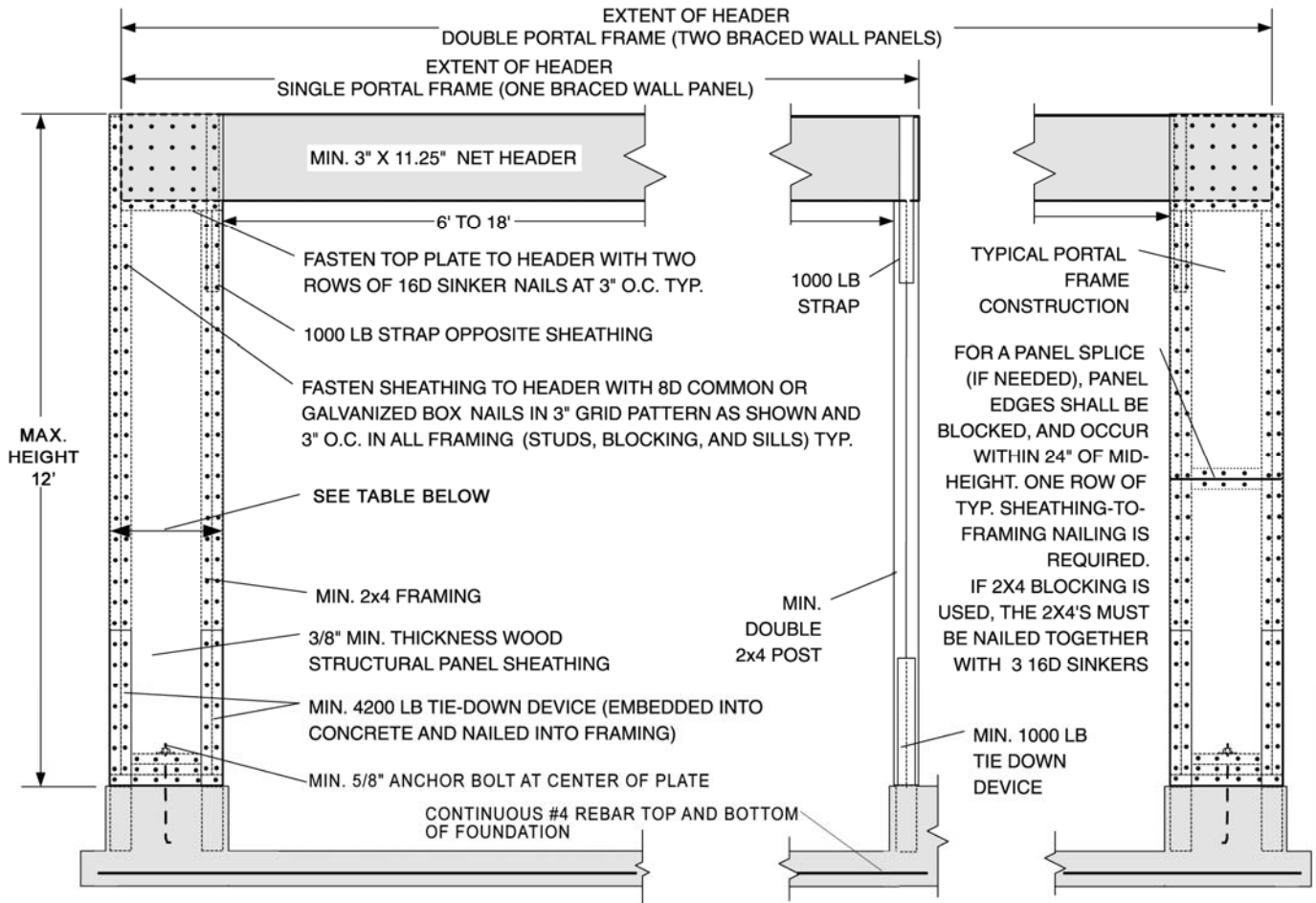
*Alternate braced wall panels* are 32" long. You can substitute an alternate panel for any other intermittent panel. In addition, when applying the minimum percentage of bracing in a *braced wall line* per TABLE 3, an *alternate braced wall panel* counts as 48" even though its only 32". Listed below are the limitations and construction requirements for an *alternate braced wall panel*.

- Location of the panel must be at the first floor for a maximum two-story house.
- The maximum height of the panel is 10'.
- Provide  $\frac{3}{8}$ " minimum OSB or plywood sheathing on one side for a one-story house, and both sides for a two-story house.
- Provide blocking at sheathing edges.
- Attach sheathing to framing with 8d nails @ 6" o.c. at edges and 12" o.c. at intermediate supports.
- Provide 2 anchor bolts below each panel at quarter points for a one-story house and 3 anchor bolts at fifth points for a two-story house.
- Provide a tie-down device at panel ends with an uplift capacity of 1,800 lbs for a one-story house and 3,000 lbs for a two-story house; see FIGURE 16 for an example of a typical tie-down device.
- Provide #4 rebar in foundation within anchor bolt and tie-down device embedment length.

### INTERMITTENT PORTAL FRAME

The portal frame option for intermittent bracing allows panel lengths to be reduced to a dimension as low as 16". However, in order to accomplish this, the construction requirements are more restrictive. See FIGURE 10 - FIGURE 13 for limitations and construction requirements. The item most often missed during construction of a portal frame is the extension of the header over the panel; see FIGURE 11.

Just like the *alternate braced wall panel* the portal frame length is considered equal to 48" when calculating the minimum percentage of bracing required in a *braced wall line* per TABLE 3.

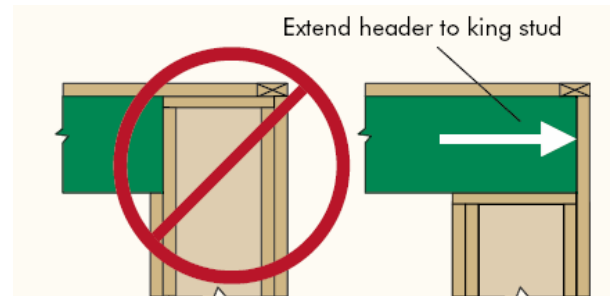


**FIGURE 10: INTERMITTENT PORTAL FRAME CONSTRUCTION**

**TABLE 4: LENGTH OF PORTAL PANEL**

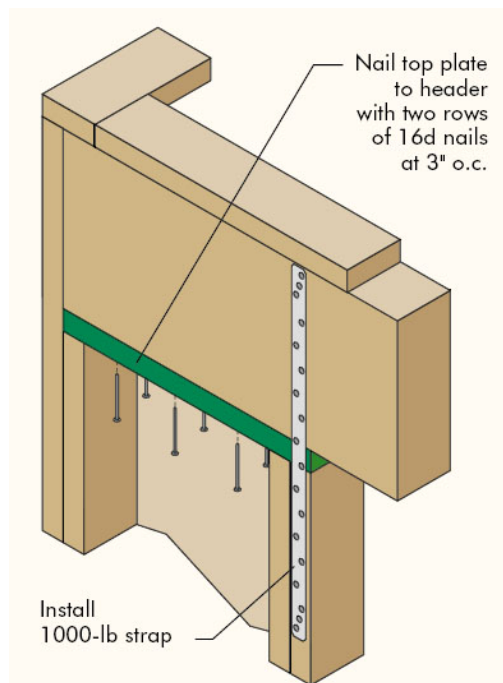
Story	Wall Height				
	8'	9'	10'	11'	12'
One-story structure	16"	16"	16"	18"	20"
First of two-story structure	24"	24"	24"	27"	29"

You can construct a single portal frame (a panel located at only one end of an opening) when only one *braced wall panel* is required, i.e., at a small window or door opening. You can construct a double portal frame (panels located at both ends of an opening) when more than one *braced wall panel* is required, i.e., at a large opening such as a garage door. *Intermittent portal frames* can only be constructed on concrete or masonry as shown above.

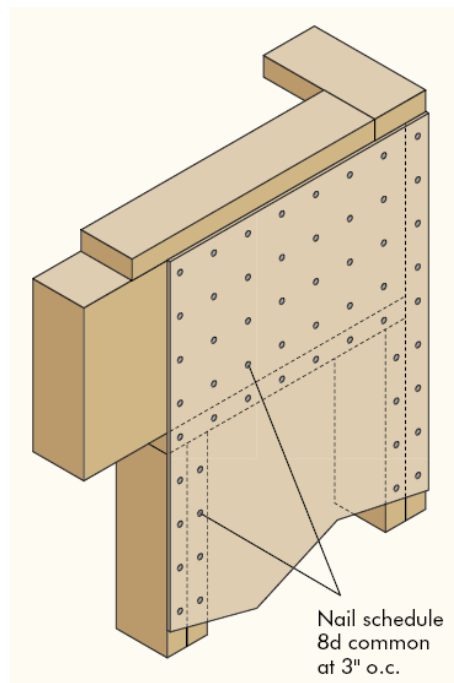


**FIGURE 11: PORTAL HEADER REQUIREMENTS**





**FIGURE 12: HEADER ATTACHMENT REQUIREMENTS FOR PORTAL FRAMES**



**FIGURE 13: SHEATHING-TO-HEADER NAILING PATTERN FOR PORTAL FRAMES**

#### **FAIRFAX INTERPRETATION: PARTIAL CREDIT FOR PANELS LESS THAN 48"**

When using intermittent bracing Methods 2 – 8, a panel with a length less than 48" can "partially" contribute to the minimum percentage of bracing from TABLE 3 and as shown in EXAMPLE 1. Use the table below to determine the contributing length for panels between 36" and 48". Any panel less than 36" cannot contribute. For example, if you had a 42" panel, you can only contribute 37" towards the percentage of bracing required.

Actual length	Amount of length allow to contribute towards % bracing*
48"	48"
42"	37"
36"	27"

\*Interpolation is permitted

### **CONTINUOUS SHEATHING**

Continuously sheathing is the second bracing approach prescribed by the IRC to resist wind load. Continuous sheathing requires you to sheath all areas of a *braced wall line*, including the areas above and below windows, with a  $\frac{5}{16}$ " minimum thickness of plywood or OSB ( $\frac{3}{8}$ " if your studs are spaced at 24" o.c.). In return, you are able to reduce the length of the *braced wall panels* to as low as 24".

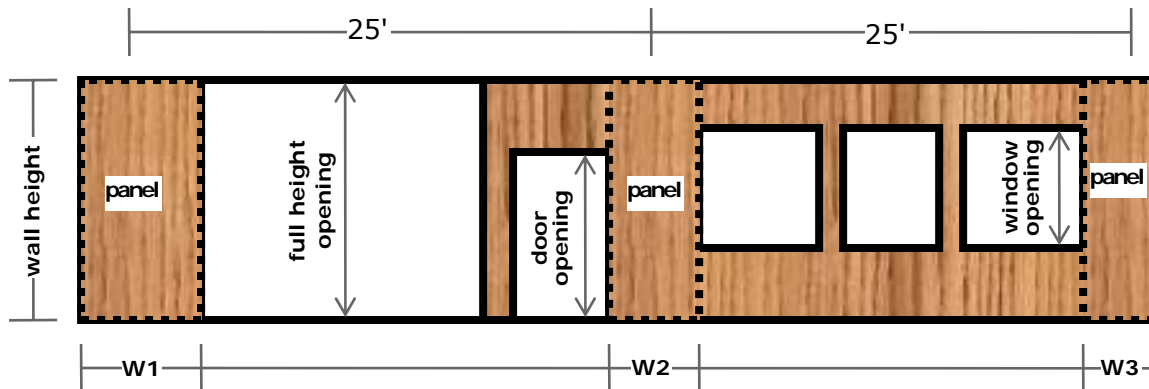
#### **NAILING REQUIREMENTS**

The nailing requirements for the attachment of all plywood or OSB to studs is 6d nails @ 6" o.c. for panel edges and @ 12" o.c. at interior supports

#### **LENGTH OF BRACED WALL PANELS**

The length of a *braced wall panel* in continuous sheathing is based on the wall height and the height of the opening adjacent the panel. Use FIGURE 14 and TABLE 5 to determine your panel length. For example, a panel adjacent a typical window opening in an 8' high wall can have a length of 24".

Please note, when a panel has an opening on each side of differing heights, the taller opening governs the panel lengths chosen from TABLE 5. Any panels less than the lengths determine from TABLE 5 are NOT considered *braced wall panels*.



**FIGURE 14: BRACED WALL PANELS FOR CONTINUOUS SHEATHING**

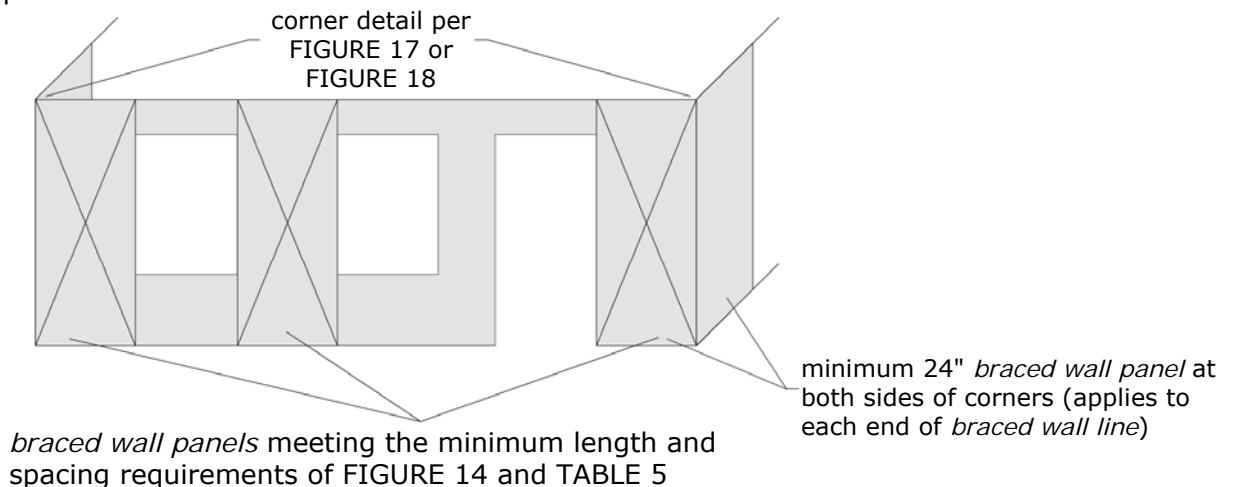
**TABLE 5: LENGTH OF BRACED WALL PANELS FOR CONTINUOUS SHEATHING\***

Wall Height	Full Height Opening 100% of wall height W1	Door Opening 85% of wall height W2	Window Opening 65% of wall height W3	Garage door opening when supporting roof only
8'	48"	32"	24"	24"
9'	54"	36"	27"	27"
10'	60"	40"	30"	30"
11'	66"	44"	33"	33"
12'	72"	48"	36"	36"

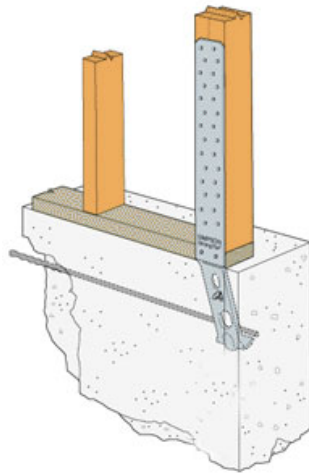
\* When a window opening is greater than 65% of the wall height or a door opening is greater than 85% of the wall height, interpolation to the larger opening size is permitted.

#### MINIMUM LOCATION OF PANELS

Like intermittent bracing, *braced wall panels* in continuous sheathing must be located at each end of the *braced wall line* and at a spacing no greater than 25' on center; see FIGURE 14 above. However, the *braced wall panels* at each end of the *braced wall line* cannot be offset. Also, a 24" minimum *braced wall panel* is required at the end of each abutting *braced wall line*; see FIGURE 15. This requirement can be eliminated if you install an 1,800 lbs. tie-down at each end of the *braced wall line*. See FIGURE 16 for an example of a typical tie-down device.



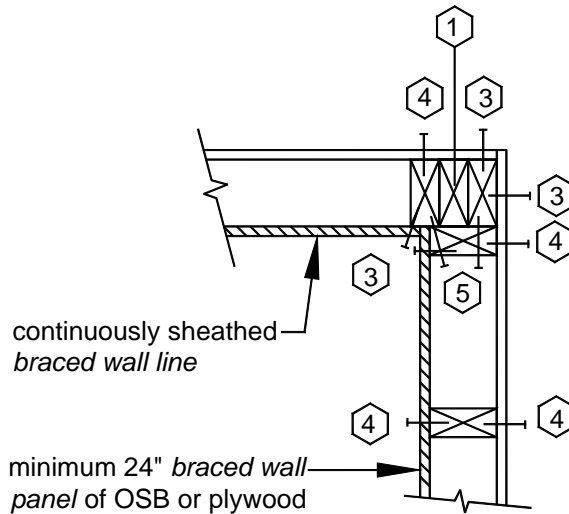
**FIGURE 15: REQUIREMENTS FOR CONTINUOUSLY SHEATHED BRACED WALL LINES**



**FIGURE 16: TYPICAL TIE-DOWN DEVICE**

**FRAMING AT CORNERS**

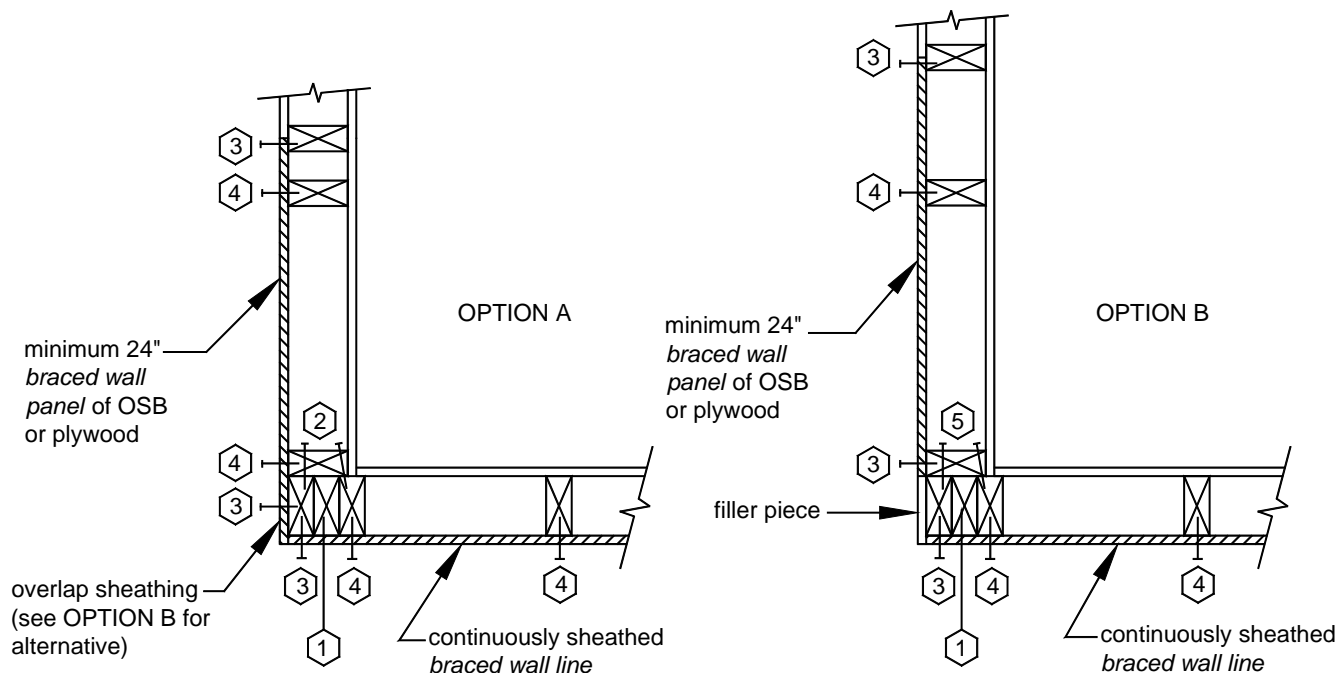
When a house is continuously sheathed, corners are required to be framed as shown in FIGURE 17 for an inside corner or FIGURE 18 for an outside corner. See TABLE 6 for the figures' legend.



**FIGURE 17: INSIDE CORNER FRAMING REQUIREMENTS**

**TABLE 6: LEGEND FOR CORNER FRAMING FIGURES**

1	2	3	4	5
Top, middle and bottom blocking or solid stud	Stud nails: 16d at 24" o.c.	Edge nails: 8d* @ 6" o.c. around all edges	Field nails: 8d* @ 12" o.c. on all framed members not at panel edges	Stud nails: 16d @ 12" o.c.
* Staples may be substituted for 8d nails as follows: For $\frac{3}{8}$ " or $\frac{5}{16}$ " sheathing, use 1- $\frac{3}{8}$ ", 15 gage or 1- $\frac{3}{4}$ ", 16 gage For $\frac{1}{2}$ " sheathing, use 1- $\frac{1}{2}$ ", 15 gage or 1- $\frac{3}{4}$ ", 16 gage				

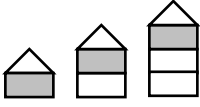
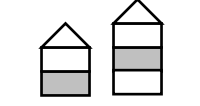
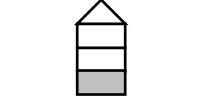


**FIGURE 18: OUTSIDE CORNER FRAMING REQUIREMENTS**

#### MINIMUM AMOUNT OF BRACED WALL PANELS

Continuous sheathing is also subject to a minimum percentage of *braced wall panels* along the length of the *braced wall line*. See TABLE 7 below to determine percent bracing required. Remember, panels less than the required lengths determined from TABLE 5 cannot contribute to the minimum percentage.

**TABLE 7: PERCENT BRACING REQUIRED FOR CONTINUOUS SHEATHING**

Floor		When maximum opening in <i>braced wall line</i> is a window 65% of wall height	When maximum opening in <i>braced wall line</i> is a door 85% of wall height	When maximum opening in <i>braced wall line</i> is full height 100% of wall height
	One story house or top floor of a two or three story house.	12.8%	14.4%	16%
	First floor of a two-story or second floor of a three-story house.	12.8%	14.4%	16%
	First floor of a three-story house.	20%	22.5%	25%

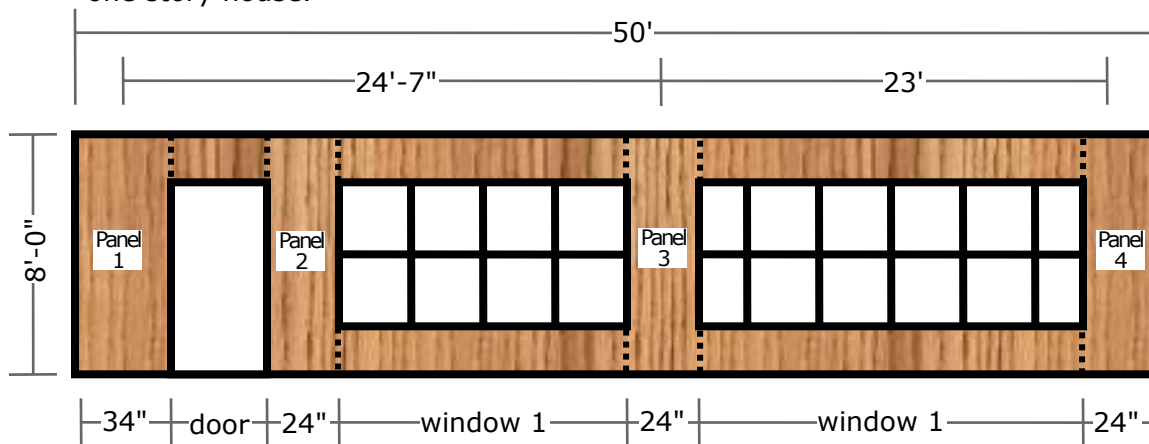
#### **EXAMPLE 2: How to evaluate compliance of a continuously sheathed *braced wall line*.**

1. Determine length of *braced wall line*.
2. Determine number of stories above *braced wall line*, if any.
3. Determine wall height.
4. Determine maximum opening in wall; i.e., window, door, or full height opening.
5. Based on above, choose the minimum percentage of bracing required from TABLE 7.

6. Evaluate the length of each full height panel to determine if the panel qualifies as a *braced wall panel* based on the lengths from TABLE 5.
7. Compute actual percentage of bracing, as follows:  

$$\text{Actual percent of bracing} = \frac{\text{sum of all panels lengths (in inches)}}{\text{length of braced wall line (in feet)} \times 12} \times 100$$
8. Compare percentages; ensure the actual percentage is greater than the minimum percentage required from Step 4.
9. Ensure panels are spaced no more than 25' on center and are located at each end of the *braced wall line*

**For example:** Determine compliance of the continuously sheathed *braced wall line* shown below for a one story house.



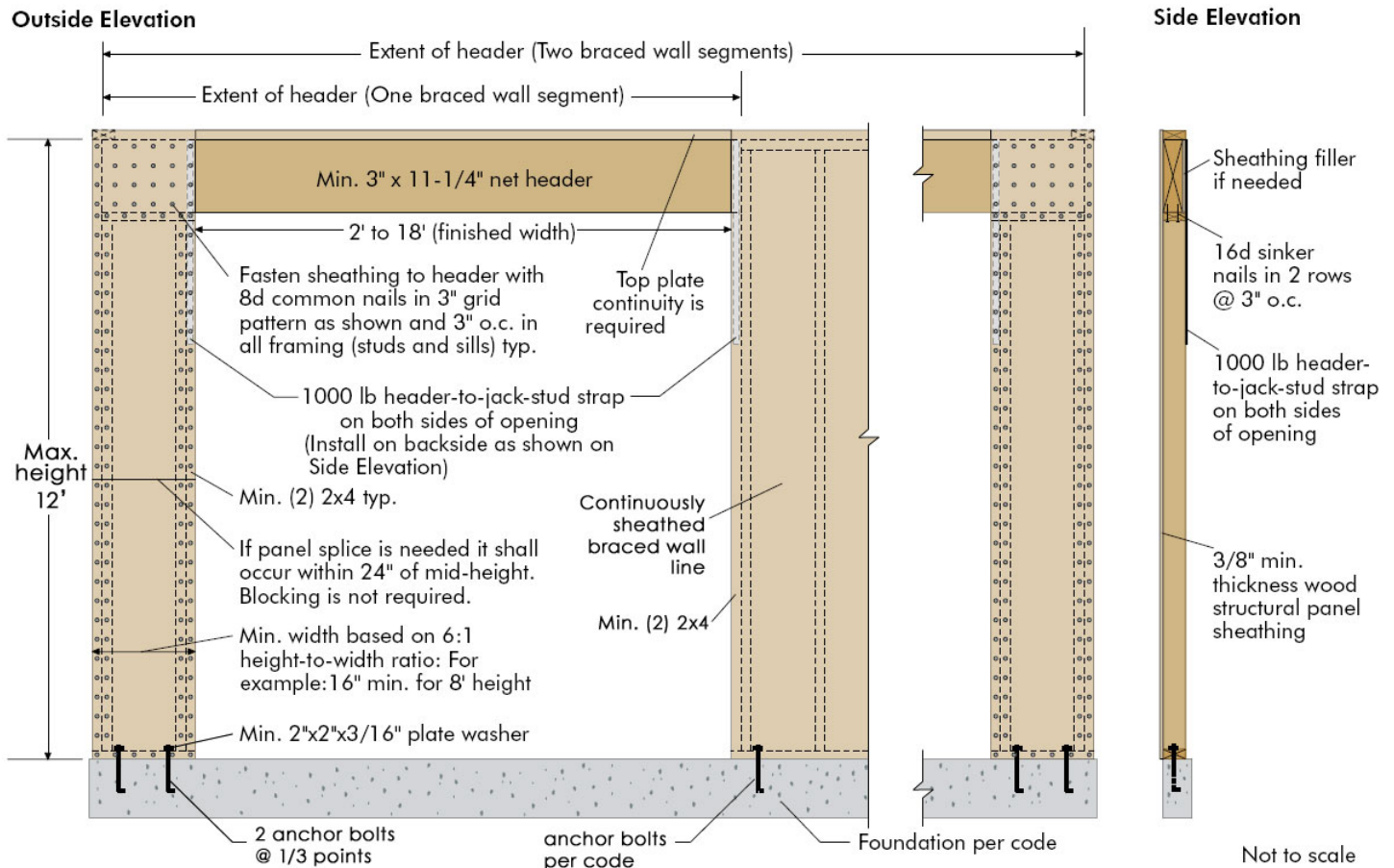
1. Length of *braced wall line* is 50'.
2. This is a one story house.
3. Wall height is 8'.
4. This wall contains a door, but no full height opening.
5. Using TABLE 7, the minimum percent bracing required is 14.4%.
6. From left to right, evaluate each panel:
  - Panel 1 is adjacent a door opening and per TABLE 5 must have a length of at least 32". Actual length is 34". **This panel can contribute.**
  - Panel 2 is adjacent a door opening and a window opening, but the taller opening governs. Therefore the panel must be at least 32". The actual length is 24". **This panel CANNOT contribute!**
  - Panel 3 is adjacent 2 window openings and must have a length of at least 24". Actual length is 24". **This panel can contribute.**
  - Panel 4 is adjacent a window opening and 24". **This panel can contribute.**
7. Compute actual percent of bracing:  

$$\% \text{ actual bracing} = \frac{34 + 24 + 24}{50 \times 12} \times 100 = 13.67\% < 14.4\% (\% \text{ required})$$
8. Actual % < Required %, *braced wall line* FAILS!

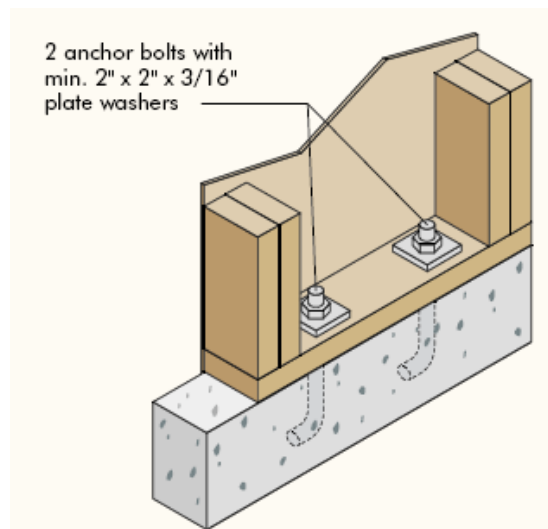
**More *braced wall panels* are required.**

## NARROW PANELS FOR CONTINUOUS SHEATHING – PORTAL FRAMES

Portal frames are the only option to reduce the length of *braced wall panels* using continuous sheathing. Continuous portal frames, often referred to as the "APA method," are similar to the portal frame shown in FIGURE 10 - FIGURE 13 for intermittent bracing with the exception of the foundation connection requirements. See FIGURE 19 and FIGURE 20.



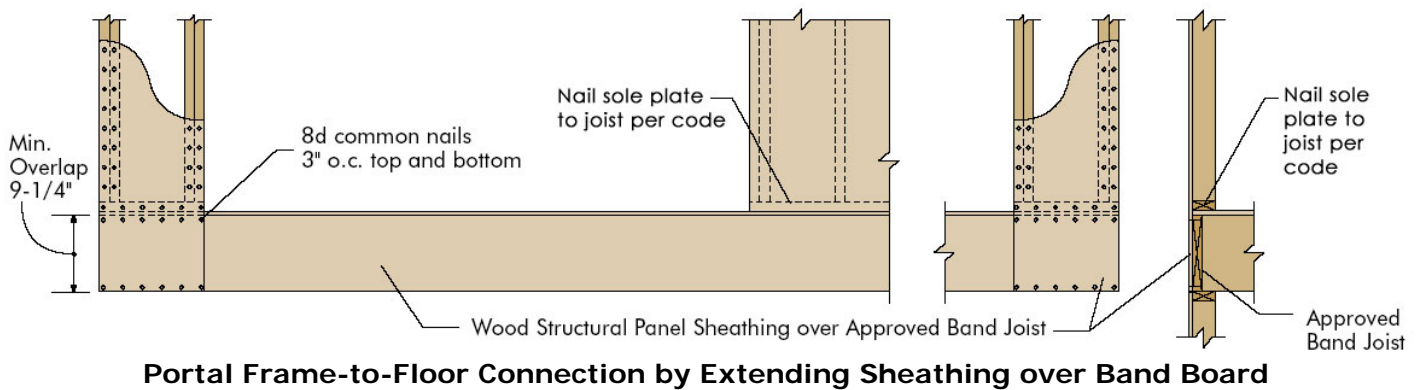
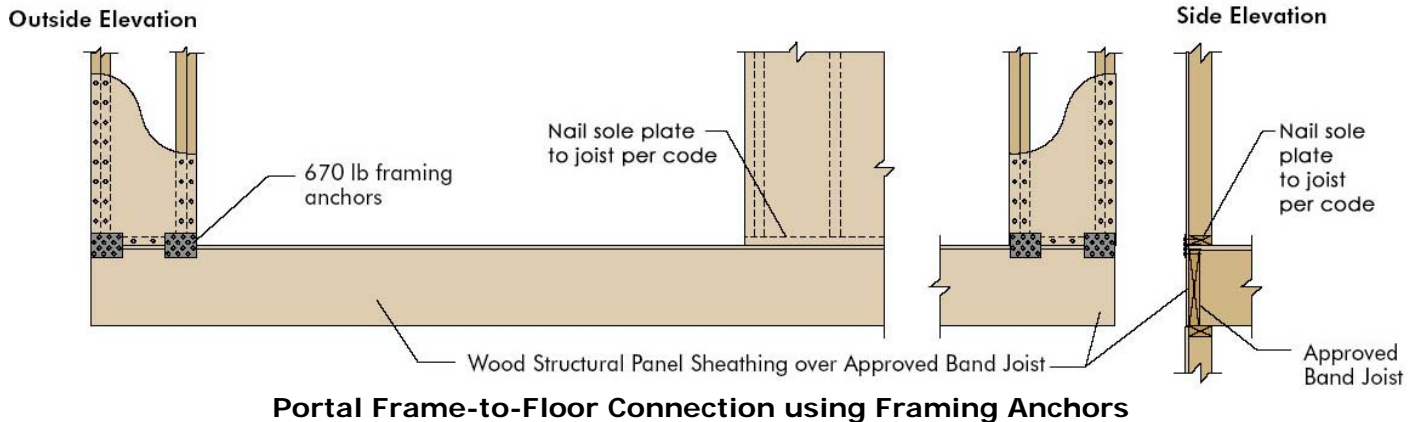
**FIGURE 19: CONTINUOUS SHEATHING PORTAL FRAME CONSTRUCTION**



**FIGURE 20: PLATE WASHERS AT CONTINUOUS SHEATHING PORTAL FRAME CONSTRUCTION**

## FAIRFAX INTERPRETATION: CONTINUOUS PORTAL FRAMES ON RAISED FLOORS

A continuous portal frame, as part of a continuously sheathed *braced wall line*, may be constructed on a raised floor or second floor. Either of the two options shown below can be used to attach the panel to the floor construction.

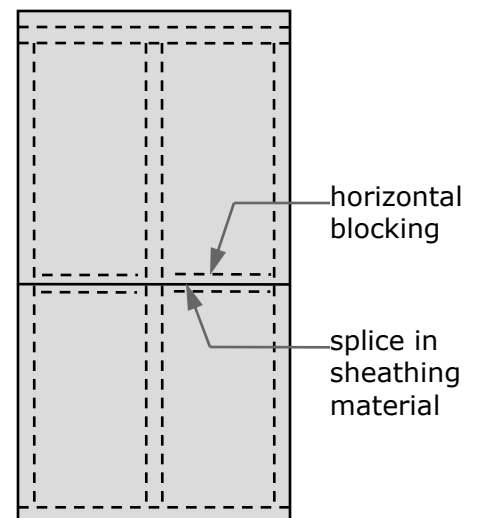


## HORIZONTAL BLOCKING

For either intermittent bracing or continuous sheathing, when bracing material is installed to construct a *braced wall panel* such that a horizontal splice occurs between the sheathing material, blocking is required for most methods. See FIGURE 21.

Blocking should be equal to the adjacent stud size and must be nailed in accordance with the connection criteria of TABLE 1. When attaching plywood or OSB to blocking for continuous sheathing, following the nailing requirements on page 9.

Any splice in sheathing for a portal frame can only occur within 24" of the mid-height of the portal *braced wall panel*.

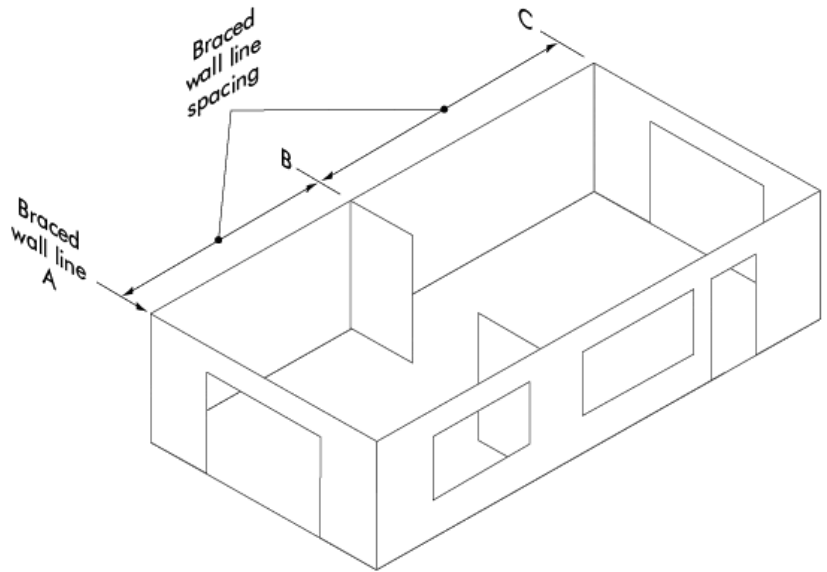


**FIGURE 21: HORIZONTAL BLOCKING**



## INTERIOR BRACED WALL LINES

Regardless of whether you choose intermittent bracing or continuous sheathing, the maximum spacing between *braced wall lines*, as required by the IRC, is 35'. This means that in a simple rectangular house, an exterior wall greater than 35' must be intersected by an *interior braced wall line*. As shown below in FIGURE 22, if the distance between *braced wall lines* A and C is greater than 35', then an *interior braced wall line*, B, must be provided. You can design this interior *braced wall line* using the provisions and interpretations shown on page 3 for *braced wall lines*. In most cases, intermittent bracing, Method-5 (drywall) can be utilized with interior partitions walls. However, the drywall attachment requirements from TABLE 1 will apply.



**FIGURE 22: BRACED WALL LINE SPACING**

When the spacing between *braced wall lines* is less than or equal to 50', you can eliminate the interior *braced wall lines* if you increase the amount of bracing in the parallel *braced wall lines*. Using FIGURE 22 as an example, the distance between *braced wall lines* A and C is allowed to increase to 50', and *interior braced wall line* B can be eliminated, if you increase the amount of bracing in lines A and C.

The amount of bracing must be increased equally in both parallel *braced wall lines* as detailed in EXAMPLE 3 below.

### **EXAMPLE 3: How to calculate the increase in wall bracing to eliminate the need for an interior *braced wall line*.**

1. Determine the required % bracing required from TABLE 3 for intermittent bracing or TABLE 7 for continuous sheathing.
2. Determine the actual spacing between *braced wall lines* (when spacing is 35' - 50').
3. Compute as follows:

$$\text{Increased \% of bracing} = \text{required \% bracing} \times \frac{\text{spacing between braced wall lines}}{35}$$

4. Use this new percentage when verifying compliance of your *braced wall line* as outlined in EXAMPLE 1, Step 4 for intermittent bracing and EXAMPLE 2, Step 5 for continuous sheathing.

**For example:** Using the house shown in FIGURE 22 with intermittent bracing, assume the distance between *braced wall lines* A and C is 42'. For a one story house, determine the increased percentage of bracing required for *braced wall lines* A and C when using Method-3 in order to eliminate interior *braced wall line* B.

1. From TABLE 3, the minimum % bracing required = 16%.
2. The spacing between the *braced wall lines* is 42'.
3. Compute increased percentage:

$$\text{Increased \% bracing} = 16\% \times \frac{42}{35} = 19.2\% \leftarrow \text{Use this figure to verify compliance of braced wall lines A and C in the manner outlined in EXAMPLE 1}$$



## PROPRIETARY SYSTEMS

Proprietary systems are pre-designed, pre-manufactured braced panels that can be used to resist wind load. Acceptable products in Fairfax County are those "listed" for International Code Council-Evaluation Service (ICC-ES) Acceptance Criteria.

The International Code Council-Evaluation Service currently has several listed products available. ICC-ES can provide you with a product evaluation report which will include manufacturer contact information, limitations for use and design loads. This report must be included with your plan submission during the permit application process. Proprietary systems must be installed in strict conformance with the manufacturer's recommendations and the evaluation report. To obtain an evaluation report, go to [www.icc-es.org](http://www.icc-es.org).

Listed below are a few of the available products.

**TABLE 8: PROPRIETARY SYSTEMS' AVAILABLE WIDTHS**

Product	ICC-ES Evaluation Report #	Available Widths	
		As a Portal Frame	As a Braced Wall Panel
Simpson Strong Tie Steel Strong Wall	ESR-1679	2", 15", 18", 21", 24"	12", 15", 18", 21", 24"
Simpson Strong Tie Shear Wall	PFC-5485	16", 22"	18", 24", 32", 48"
Weyerhaeuser TJ Shear Panel	ESR-1281	16", 22"	18", 24", 32", 48"
Hardy Panels*	PFC-5342	12", 18", 24"	12", 18", 24"

\* Hardy Panels attached directly to concrete or masonry foundation can be stacked for two-story walls if designed by a licensed design professional in accordance with Hardy Frame, Inc. specifications.

## ENGINEERED DESIGN

If you wish to deviate from the requirements of IRC, then you must have your wall bracing designed by a registered design professional licensed in the Commonwealth of Virginia.

To determine wind load, the calculations must follow the requirements of Section 1609 of the International Building Code (IBC). The basic wind speed for Fairfax County is 90 mph. Most residential construction in Fairfax County qualifies as Exposure B with an Importance Factor ( $I_w$ ) of 1.00. **Please note: wind load must be applied to both windward and leeward sides simultaneously.**

### DESIGN METHOD AND CALCULATIONS

Section 2305 of the IBC, "General Design Requirements for Lateral-Force-Resisting Systems," and accepted engineering practice shall be employed in the design professional's calculations.

Calculations, at a minimum, must:

- Show a detailed analysis of the wind load determination.
- Show a detailed design of the building diaphragms (Section 2305.2) and shear walls (Section 2305.3).
- Specify the sheathing thickness, nail sizes and nailing pattern for diaphragms and shear walls.
- Ensure there is an adequate load path to the foundation.
- Show a detailed analysis of all connections along the lateral load path.
- Show an analysis of the existing lateral load resisting system with the new applied loads when utilizing an existing structure to resist lateral loads of an addition.
- Ensure post-to-beam connections are capable of resisting shear and rotation.
- Bear the original signature and seal of the registered design professional.

**Calculations which do not meet the above requirements will not be approved by Building Plan Review during the permit application process.**

## CONSTRUCTION DOCUMENTS

When submitting plans for a building that utilized an engineered design, the related calculations must be attached to the plans. The drawings must also include comprehensive details outlining the construction requirement of the diaphragms and shear walls. These detail sheets must also bear the original signature and seal of the responsible design professional.

## **FAQS: FREQUENTLY ASKED QUESTIONS**

**There have been no major catastrophic events in Fairfax County due to wind. What has prompted these new wind bracing requirements?**

One driving force for stricter wind bracing provisions in the IRC has been the insurance industry who's involvement in building code development intensified after Hurricane Andrew in 1992 and the Northridge Earthquake in 1994. While Fairfax County has not recently experienced a widespread and devastating wind event, the code requires all residential construction to be designed to resist the potential for such events. A jurisdiction's probability for wind events is based on its proximity to the coastline and/or other high wind regions. Hurricane Isabel in 2003, and the tornados from Hurricane Ivan in 2004 are just a few reminders of the potential in Fairfax County for high winds.

**Can I construct a cripple wall above a portal frame at a garage door opening?**

Yes. However, the total height of the wall from the bottom plate of the portal panel to the top plate of the cripple wall cannot exceed 12'.

**What are the requirements for wind bracing if I construct an enclosed room atop my deck?**

The wall of your new room must meet the requirements of this publication. However, if your deck is more than 2' above the ground, the elevated floor, as supported by posts, must be braced in accordance with accepted engineering practice.

**If my design does not meet the prescriptive requirements of the IRC, what are my options?**

You have two options. The first is to use a proprietary system such as those from Simpson Strong-Tie, Weyerhaeuser or Hardy Frame. See **Proprietary Systems** above for more information. The second is to have the structure designed by a registered professional licensed in the Commonwealth of Virginia. When applying for a permit, this option requires the submission of the signed and sealed design calculations and a comprehensive set of construction documents outlining the lateral load resistance system. See **Engineered Design** above for more information.

**Are Simpson Strong-Tie, Weyerhaeuser and Hardy Frame wall bracing products available on the east coast?**

Yes. Representatives from all companies have indicated that their products are available to builders in our area. For more information, contact Simpson Strong-Tie at **1-800-999-5099**, Weyerhaeuser at **1-800-242-4854**, and Hardy Frame at **1-800-754-3030**. A full list of shear wall products acceptable in Fairfax County can be found at [www.icc-es.org](http://www.icc-es.org).

**Can Thermoply/Energy Brace be used as a braced wall panel?**

Yes, only if they are constructed in strict conformance to the product's ICC-ES Evaluation Report (2407). Thermoply/Energy Brace may be used as an equivalent to Method-4.

Sources: International Code Council, American Plywood Association, Simpson Strong-Tie

**Fairfax County is committed to a policy of nondiscrimination in all County programs, services and activities and will provide this document in alternative formats and in different languages upon request. Please call 703-324-5033, TTY 711 or write Department of Public Works and Environmental Services, Suite 659, 12055 Government Center Parkway, Fairfax, VA 22035-5506. Please allow at least seven working days for preparation of material.**